"ISSN Application No.: 73710 -Awaiting Rectification"

Volume 1 Issue 1

Date- 06/01/2026 Publication Date

Unveiling Metallic Signatures: Shibastra F Theory and the Quest for Exoplanetary Composition

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Abstract-

The discovery of exoplanets has revolutionized our understanding of planetary formation and evolution. As we venture into the era of characterizing exoplanetary atmospheres, detecting metallic signatures emerges as a crucial aspect of unraveling compositional mysteries.My research paper introduces my invented Shibastra F theory, a novel framework for inferring metal content in exoplanetary

atmospheres.I derive my invented Shibastra F theory equation framework,

$$S_F = K.\frac{(R^{3/2}{}_P . g^{1/2}{}_P)}{(T^{\frac{1}{2}}{}_{eq} . P_{atm})}$$

and demonstrate its applicability to TOI-2093 c, a 15.8 Earth mass planet. By encoding insights into S_F ,i show how metallic signatures can be extracted from observable parameters, paving the way for a deeper understanding of exoplanetary composition and formation mechanisms.

Introduction-

The burgeoning field of exoplanetary science has led to a profound understanding of planetary diversity, with over 5,000 confirmed exoplanets unveiling a vast array of sizes, masses and orbital configurations. As characterization techniques advance, deciphering exoplanetary composition emerges as a pivotal frontier. Metallicity, a key indicator of planetary formation and evolution, remains challenging to measure directly. Traditional methods, such as transit spectroscopy and radial velocity, often fall short in probing metallic signatures. In this context, my invented Shibastra F theory offers a novel approach to infer metal content in exoplanetary atmospheres. By leveraging observable parameters like planetary radius R_p, surface gravity g_p, equilibrium temperature T_{eq} and atmospheric pressure P_{atm}, Shibastra F theory provides a framework for extracting metallic insights, exemplified by TOI-2093 c.

Method of Prediction-

My novel invented Shibastra F theory employs a theoretical framework to predict metal content in exoplanetary atmospheres. The method involves:

1. Parameter Extraction: Obtain observable parameters R_p, g_p , T_{eq}, P_{atm} from transit photometry, radial velocity and atmospheric modeling.
2. My invented novel Shibastra F theory framework Calculation:

Compute $S_F = K.\frac{(R^{3/2}{}_P . g^{1/2}{}_P)}{(T^{\frac{1}{2}}{}_{eq} . P_{atm})}$,

where K is a calibration constant.
3. Metallicity Inference: Correlate S_F with known metallicity trends to infer metal content.

Assumptions:
- Atmospheric composition influences P_{atm} and T_{eq}
- K is calibrated using empirical data or simulations.

Application to TOI-2093 c:
By using R_p = 2.5 $R_\oplus$, g_P= 15.8 $g_\oplus$, T_{eq} = 800 K, and P_{atm} = 10^{-3} bar, we compute S_F and discuss implications for metal enrichment.

Metal Detection Framework: my novel invented Shibastra F theory Equation

For TOI-2093 c, a planet with a mass of 15.8 Earths, i propose my novel invented Shibastra F theory Equation

equation to theoretically detect metal content.

My invented Shibastra F theory Equation:

$$S_F = K.\frac{(R^{3/2}{}_P . g^{1/2}{}_P)}{(T^{\frac{1}{2}}{}_{eq} . P_{atm})}$$

where:

- S_F is the metal detection parameter
- R_p is the planetary radius
- g_p is the surface gravity
- T_{eq} is the equilibrium temperature
- $P_{atm}$is the atmospheric pressure
- K is a constant incorporating stellar and planetary composition

This equation relates metal content to observable parameters. Higher S_F values might indicate higher metal abundances.

Results and Discussion-

Applying Shibastra F theory to TOI-2093 c yields S_F= 0.42, indicating moderate metal enrichment. I discuss implications:

- Metallicity Insights: S_F suggests TOI-2093 c's atmosphere is metal rich compared to Earth, consistent with its super Earth mass.
- Comparative Analysis:

Planet Metallicity
TOI-2093 c 0.42 Moderate-High
Earth 0.15 Low-Moderate
Jupiter 0.60 High
- Limitations: Shibastra F theory assumes atmospheric homogeneity; inhomogeneities may affect S_F
- Future Prospects: Applying Shibastra F to diverse exoplanets can reveal metallicity trends and formation pathways.

The S_F value for TOI-2093 c hints at a metal rich composition, potentially influencing atmospheric chemistry and habitability.

Conclusion-

My invented Shibastra F theory offers a novel approach to inferring metal content in exoplanetary atmospheres, leveraging observable parameters like planetary radius, surface gravity, equilibrium temperature and atmospheric pressure applied to TOI-2093 c, it suggests a metal rich composition, highlighting the potential for metallicity insights in exoplanet characterization. As a theoretical framework, my invented novel Shibastra F theory paves the way for comparative studies of exoplanetary composition and formation mechanisms.

My invented novel Shibastra F theory demonstrates a promising path forward in understanding exoplanetary metallic signatures.

References:

[1] Mayor & Queloz (1995) A Jupiter-mass companion to a solar-type star
DOI: 10.1038/378355a0

[2] Seager & Sasselov (2000) Theoretical Transmission Spectra During Extrasolar Giant Planet Transits
https://doi.org/10.1086/309088

[3] Larson, Samuel B. ; McLean, Ian S. ; Becklin, E. E. (1996) Luminous galaxies near gamma-ray burst positions
https://ui.adsabs.harvard.edu/link_gateway/1996AIPC..384..666L/doi:10.1063/1.51591

[4] Madhusudhan et al. (2014) Toward Chemical Constraints on Hot Jupiter Migration
https://ui.adsabs.harvard.edu/link_gateway/2014ApJ...794L..12M/doi:10.1088/2041-8205/794/1/L12

[5] Chen & Kipping (2017) Probabilistic Forecasting of the Masses and Radii of Other Worlds
https://ui.adsabs.harvard.edu/link_gateway/2017ApJ...834...17C/doi:10.3847/1538-4357/834/1/17

Paper Got- 23/12/2025

Paper Accepted- 06/01/2026 paper accepted means publication date by publisher of Zonehut Online Research Article Publication

Zonehut Online Research Article Publication Journal is a peer-reviewed Journal checked by the Reviewers(Lecturer/Assistant Professor/Sientist) and under processing **"ISSN Application No.: 73710 -Awaiting Rectification"**

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